



# Title of Presentation

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## **LESSONS FROM MOL: DEVELOPMENT OF NUTRITION AND ASSOCIATED TECHNOLOGIES**

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# DISCLAIMER

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The views expressed are those of the author and do not necessarily reflect the official policy or position of NASA or the U.S. Government.



# Disclosure Information

*88<sup>th</sup> Annual Scientific Meeting*

*Michele Perchonok, Ph.D.*

I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation.



# Feeding System Requirements Food

- One day's food: 3 snacks, 1 main meal, beverages
  - Time allowances – includes retrieve, prepare, consume, clean up
    - Snacks – 10 minutes
    - Main meal time (prep, consume, stow waste) – 45 min
- Total calories – averaged 2579kcal/day (4.9 kcal/g)
- Caloric distribution
  - Fat, 27-34%; Protein, 10-15%; Carbohydrates, 50-58%
- 6-day cycle
- Each item scored  $\geq 6$  on 9-point scale





# Typical MOL Menu for One Day

Item	Energy (Kcal)	Item	Energy (Kcal)
Meal A		Meal D	
Bacon bars, 4	102	Apricot cubes, 4	132
Pineapple cubes, 4	130	Peanut cubes, 4	143
Strawberry cereal cubes, 4	<u>123</u>	Cinnamon toast, 8	<u>97</u>
	355		372
Meal B		Beverage composite	
Brownies, 4	111	Cocoa	195
Shrimp cocktail	149	Tea, with lemon and sugar	31
Beef and gravy	193	Grapefruit drink	80
Corn bar	112	Orange drink	80
Chocolate pudding	<u>313</u>	Pineapple-grapefruit drink	80
	878	Orange-grapefruit drink	<u>80</u>
			546
Meal C			
Pineapple fruitcake, 4	274		
Coconut cubes, 4	<u>138</u>		
	412		

## Summary

Ave. kcal/day	2579
Ave. wt. food/day	539 g



# MOL Food Stowage for 30 days for 2 crewmembers

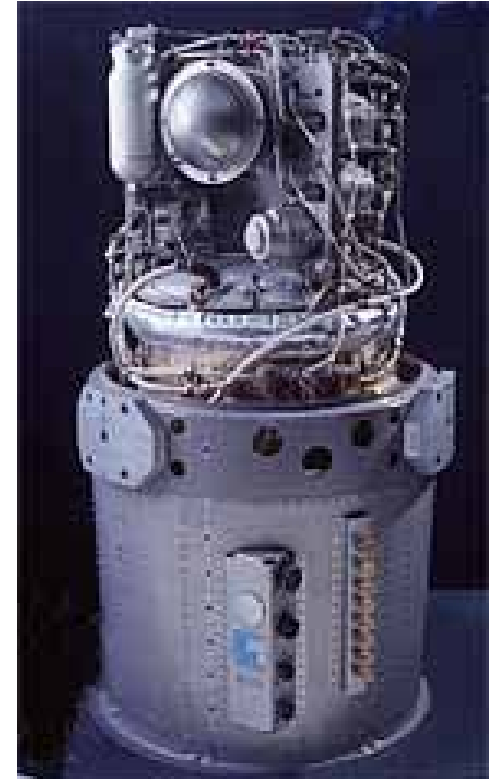
- Volume
  - 47,925 cu<sup>3</sup> (2,925 in<sup>3</sup>)
- Mass
  - 12 kg (25.5 lb)
  - Packaging ~33% of mass (waste)
- Tolerate  $T \leq 100^{\circ}\text{F}$ ,  $\text{RH} \leq 100\%$ ,  $P = 5 \pm 0.2$  psia, 70% O<sub>2</sub>, 30% He





# Water Supply – used for rehydratables and beverages

- Based on Apollo system
  - Silver ion generator anti-microbial
- Volume
  - Production: 5200 ml (176 oz)/day
  - Delivery rate: 5 oz (148 ml)/min
- Temperature
  - Cold: 40-70°F
  - Hot: 145-155°F
- pH = 6-8

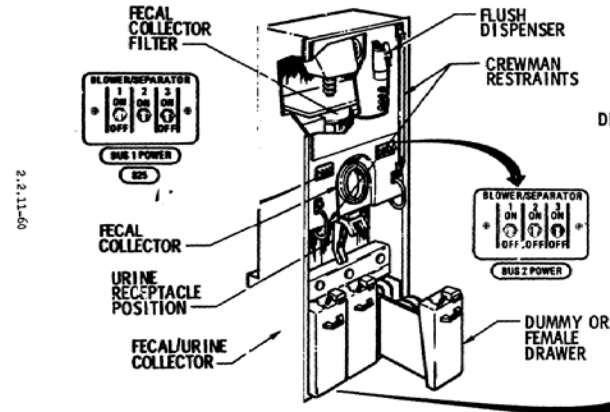
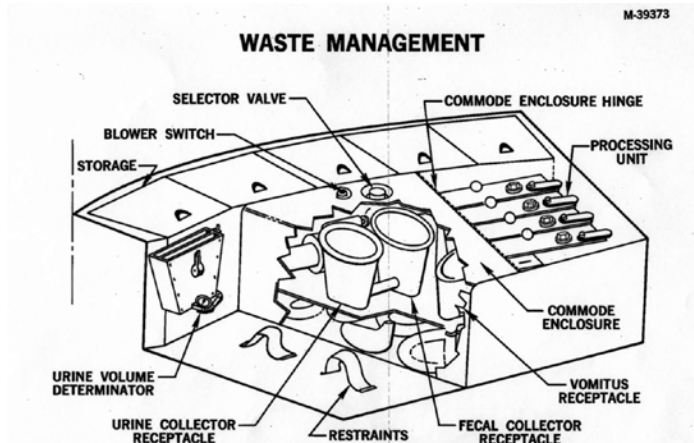




# Waste Collection

- Layout similar to Skylab
- Waste Processor
  - Used a vacuum to dry urine and feces
  - Multiple waste processors were likely needed since evaporation rate could have been greater than 24 hours
  - Skylab did not use a heat exchanger

MOL



Skylab





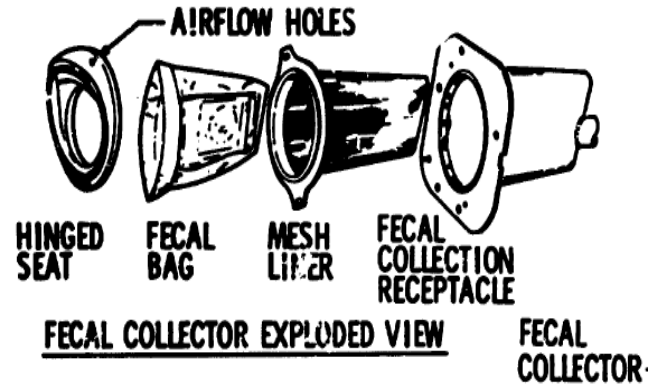
# Fecal Collection

The MOL seat looks very similar to the Skylab seat

- The fecal bag approach is very different.
- The MOL urine collection bag may be the basis for the Skylab fecal bag design (gas permeable membrane section)



MOL



Skylab



# AstroVac – Zero Gravity Personal Body Wash Unit





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# QUESTIONS?

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